Société de Calcul Mathématique, S. A.
Outils d'aide à la décision

IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

Malfunctions in radioactivity sensors' networks

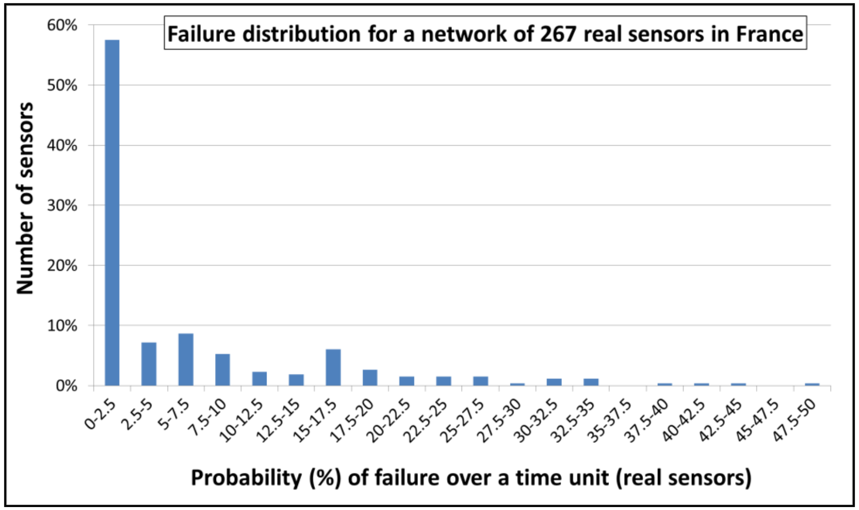
2017 ANIMMA – Poster presentation

Guillaume Damart
06/21/2017

Sensors' malfunctions and characteristics

- Uncertainty upon the measurements: It is given by the constructor but can increase with time. You have to consider uncertainties when choosing thresholds.

- Failures (probability over a time unit): Sometimes the sensor stops sending values.

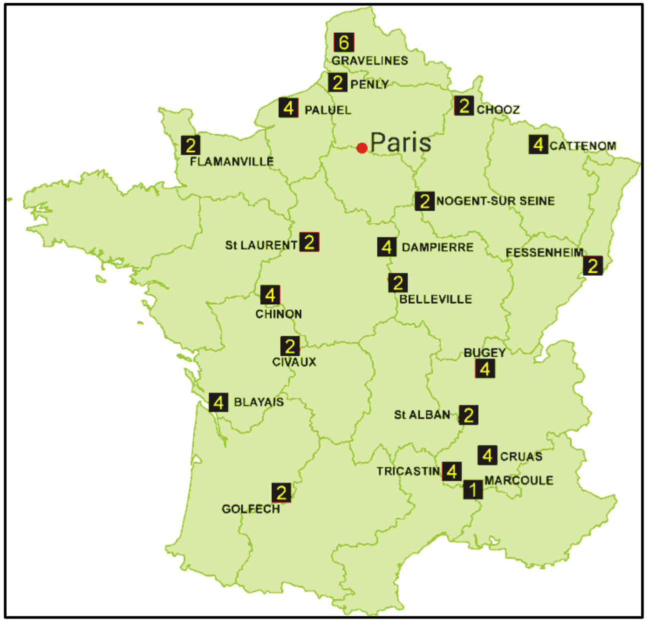


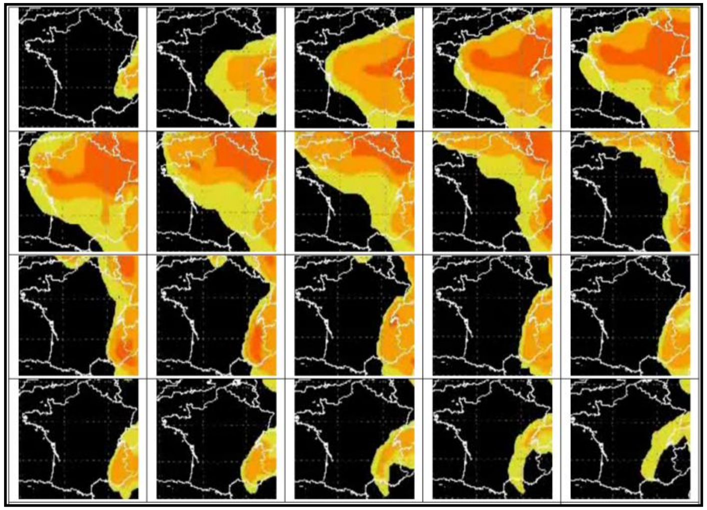
- False alarms: Very costly for the operator (need to send emergency services to evacuate populations). Every alarm sent has to be checked.

- Area of detection: A sensor will represent a given area, for example a circle of 20 km radius. This value must be determined before setting up the network.

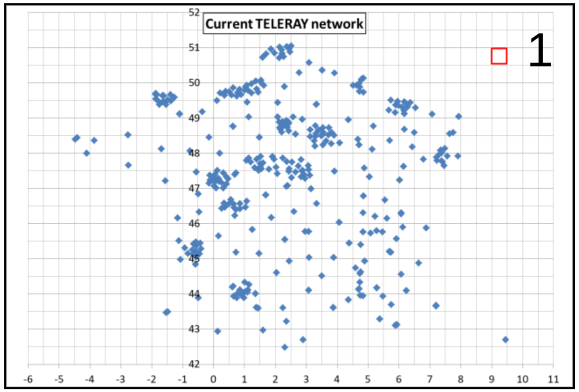
What should a network do ?

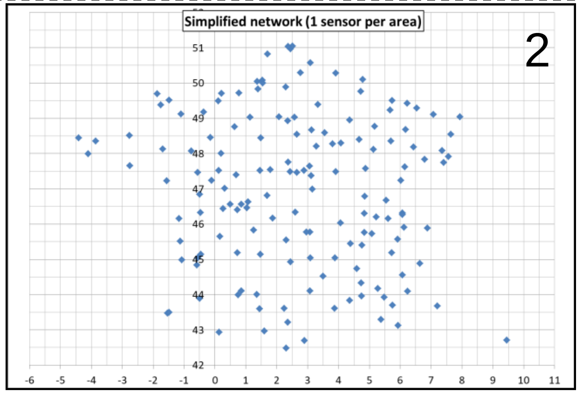
- Target risk areas (nuclear plants, sensitive borders)
- Roughly monitor the rest of the territory
- Verify sensors' data by vicinity
- Reconstruct missing data (failures): Data of sensors in the vicinity of a broken sensor must suffice to reconstruct missing data.
- Use data fusion of different types of sensors: It is better to have different technologies to monitor the same phenomenon (to prevent complete failures of the network).

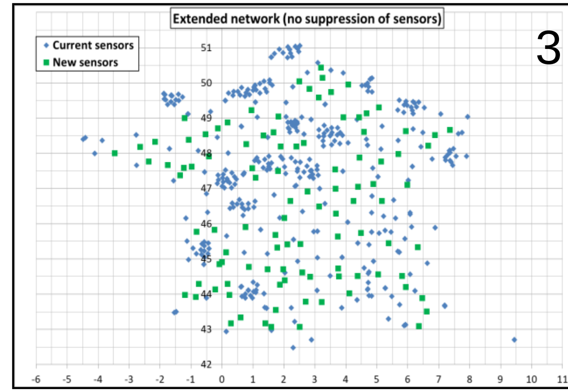




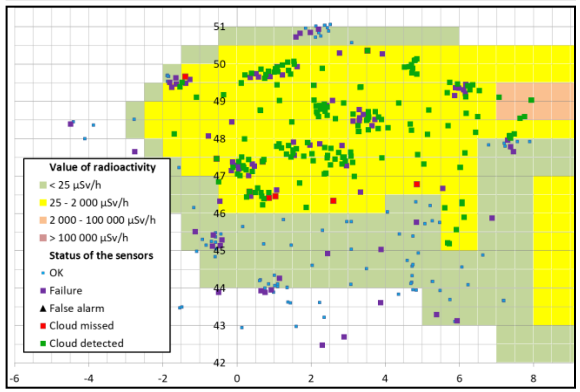
Simulation of detection by TELERAY (IRSN, France)



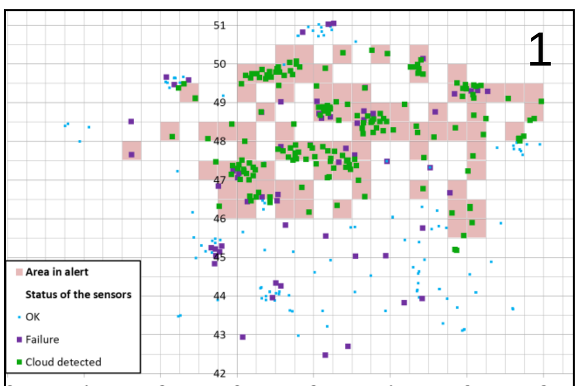


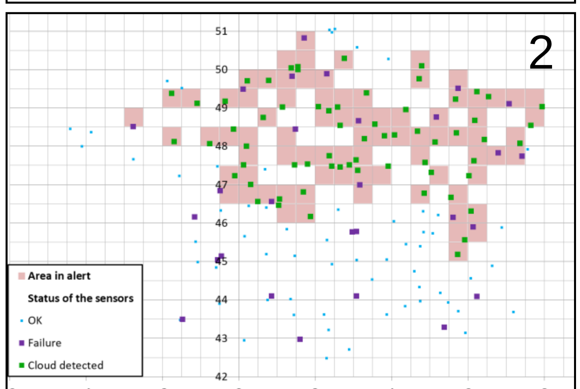


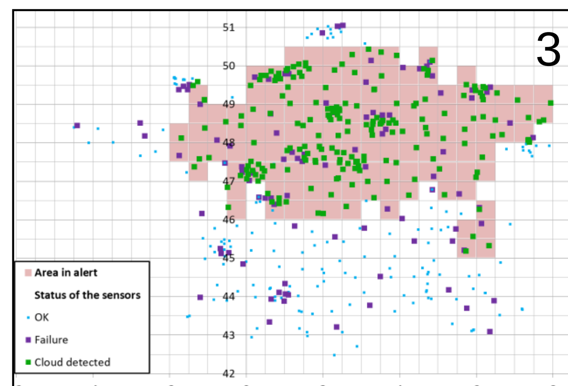
1- Current network: 425 sensors mostly placed near to nuclear plants.
2- Simplified network: we remove most of the sensors near to nuclear plants.
3- Extended network: authorities do not want to remove any sensor. We add sensors in areas not monitored.



1- Current network: 54 % of the cloud detected. Not efficient: too many sensors in restricted areas and not enough in large areas.
2- Simplified network: 54 % of the cloud detected. Same detection as 1 but more relevant repartition.
3- Extended network: 84 % of the cloud detected. Good efficiency: costly but detects well the threat.







Other ways of detection ?

- Mobile units: A restricted but robust network will allow to detect a threat. Mobile units can be sent to characterize it more precisely.

- Create a database of simulations: Nuclear safety authorities should create exhaustive databases of potential threats (not only radioactivity, but also meteorological parameters like wind, temperature, humidity...).

- Using data from other networks: for example, meteorological network of Météo France is much more spread out than TELERAY.